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ABSTRACT

This report presents an indication of existing workforce levels and career potentials for environmental/energy occupations within private industry. The study concerns itself with the environmental pollution control areas of air, noise, potable water, pesticides, radiation, solid waste, wastewater, and energy. The format includes an introduction to the study with appropriate definitions, the objectives, the survey approach and results, and conclusions. A selected bibliography is included for reference. (CS)

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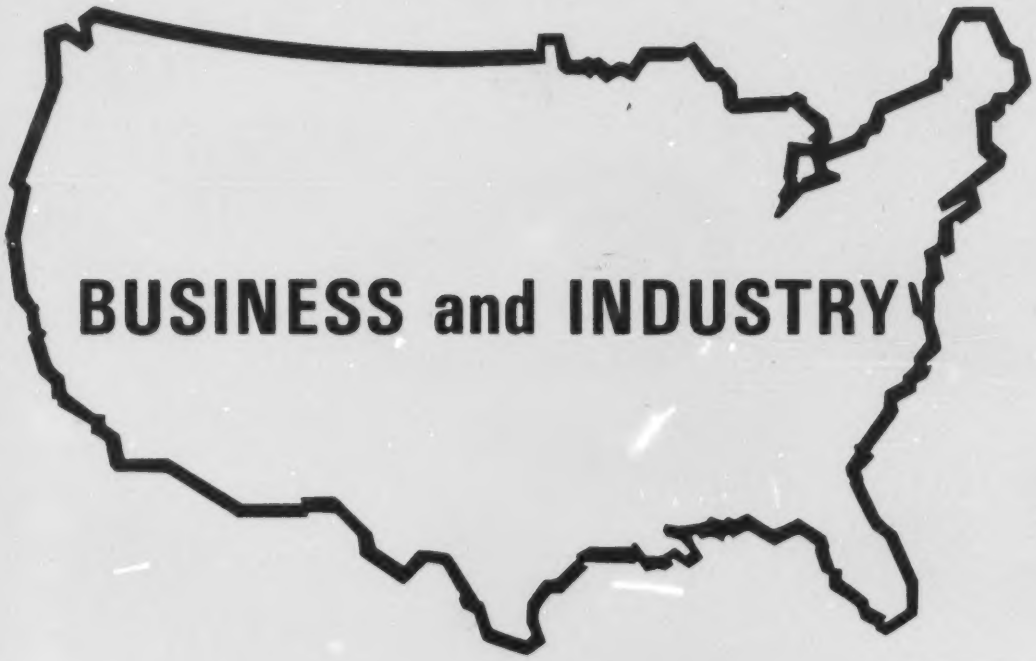
A National Environmental/Energy Workforce Assessment



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NATIONAL ENVIRONMENTAL/ENERGY

WORKFORCE ASSESSMENT

BUSINESS and INDUSTRY

Conducted by:

NATIONAL FIELD RESEARCH CENTER, INC.

Under Grant from:

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Of equal importance was the cooperation and assistance of scores of company officials and representatives of trade associations who devoted time and effort to meet with National Field Research Center staff members and respond to telephone and mail inquiries.

PREFACE

This report presents an indication of existing workforce levels and career potentials for environmental/energy occupations within private industry, based on information currently available. The study was carried out for the United States Environmental Protection Agency by National Field Research Center of Iowa City, Iowa. The information and data presented in this report were compiled in large part from extensive interviews with professionals working in the private sector and were supplemented by telephone and mail surveys and research.

FOREWORD

The material herein contains the information and data collected from the private industrial sector in the areas of pollution control and abatement. Included are indications of current workforce levels and career potentials as supplied by numerous industrial respondents. Much of the information presented is based upon best professional estimates developed from available information and is representative of a particular company or group of companies rather than the industry as a whole.

BUSINESS and INDUSTRY

INTRODUCTION

This study of private sector environmental workforce needs is an essential component of the National Environmental/Energy Workforce Assessment conducted by National Field Research Center, Inc., (NFRC) of Iowa City, Iowa. The desirability of accurate projections of the environmental workforce needs of industry has long been recognized, and several attempts have been made to develop them. Therefore, this study was initiated with a review of literature resultant from previous assessment and projection efforts.

The review revealed several significant inadequacies of previous studies which must be dealt with if future studies are to result in reliable, useful products. The inadequacies, categorized as matters of scope, data bases, definitions, and samples, are identified and discussed below.

Scope

Previous studies of the industrial environmental workforce were components within projects of a much broader scope or pertained to only one pollution control area.

Perhaps the best of the former is the 1972 Environmental Job Opportunities Survey prepared by Automation Industries, Inc., for the U.S. Department of Labor, Office of National Projects Administration and the U.S. Environmental Protection Agency, Office of Planning and Management.[1] The greatest contribution of the study, as it pertains to industry, is not in quantitative data, but in the identification of problem areas likely to affect future studies.

By and large, the same problems were encountered in the NFRC assessment. The 1972 study will be referred to frequently in the discussion of the inadequacies which contribute to the problems.

The air and water pollution control areas are the best represented of the single area studies. Air pollution control workforce studies include Faith (1969), Moeller (1974), and U.S. Congress, Senate (1970). Water pollution control workforce study literature includes Middlebrooks (1974a), Middlebrooks (1974b), Middlebrooks (1975), and U.S. Congress, House (1972).

Data Bases

Premises and assumptions employed to formulate data bases varied significantly from study to study.

In 1972, Coplon and Smith noted that the U.S. Congress, House (1972) report contained projections for the water pollution control workforce for 1976 which exceeded the Automation Industries 1975 projection for all pollution control areas by a factor of three.[2]

Several studies begin with the premise that a definitive relationship between pollution control expenditures (primarily capital investment) and pollution control workforce needs exists. This is most likely due to industry's predilection toward measuring impact and planning for the future in terms of dollars invested, often to the exclusion of other considerations. Thus, a variety of sources are available for reference and comparisons which measure pollution control efforts in terms of dollars invested (McGraw-Hill, 1976; McGraw-Hill, 1977; Cremeans, et al., 1975; Chase Econometrics Associates, 1975.)

Methodology has been developed which uses capital expenditures, operation and maintenance costs, and research and development funding for base data in workforce needs projection (Lecht et al., 1974). However, several unsubstantiated assumptions are incorporated into the methodology which are causes of concern as to the adaptability of the methodology to changing economic and regulatory conditions. A major potential flaw is the assumption of a direct relationship between pollution control capital investment and environmental personnel requirements.

No data are available specific to pollution control personnel which suggest an identifiable ratio of capital expenditures and employment. If such data are developed, it must be taken into account that the pollution control areas vary as to capital intensity; thus, a recognizable ratio of capital expenditure to water pollution control personnel is not readily adapted to air pollution control personnel.

Studies which employ capital expenditures as an indicator of environmental control personnel requirements are likely to produce projections which differ substantially from studies which begin with an assessment of the current workforce level from an "actual count" perspective.

Definitions

Uniform definitions to determine parameters of "environmental personnel" were not used.

Each study cited includes a statement as to definition of environmental or pollution control personnel or environmental activities. Most also state that the definitions are inadequate, but are the best available for the purpose of the study.

Samples

Samples were small and representativeness often not substantiated.

Coplon and Smith (1972) is the most comprehensive study to date in that, "the survey attempted to identify current and future (through 1975) jobs for professional or technical personnel in the EPC fields of air, water, solid waste, pesticides, noise, and radiation."[3] In the section which discusses conduct difficulties, the authors state, "...the modest size of the industrial sample reduces the number of national estimates which can be made and places those which are made in some doubt."[4]

These inadequacies contribute to the following problem areas which make much of the data obtained in previous studies of questionable value for planning and decision-making:

1) The studies in which the private sector represented but one component produced data which were, in many respects, too scanty from which to formulate projections of reasonable accuracy.

2) Data relevant to one pollution control area, as obtained in the single area studies, are often not applicable to other pollution control areas.

3) The range in scope of previous studies (from one pollution control area to the full gamut of areas under the purview of the U.S. Environmental Protection Agency) is detrimental to comparability of data and projections from study to study.

4) The variety of data bases arrived at from disparate premises and assumptions further impairs the comparability of study results.

5) The absence of uniform definitions of "environmental personnel" is deleterious to comparability of studies and may be a source of inaccuracy within a study if adequate controls (such as uniform instructions to employers as to which employees to include in the data they provided) were not maintained.

6) Non-representative samples increase the disparity of data and projections among the studies and could lead to decisions based on inadequate or misleading information.

OBJECTIVES

Upon identification of the problem areas within and among previous private sector environmental workforce studies, the nature of the study to be conducted by National Field Research Center was reassessed.

The problems inherent in previous studies remained unresolved and, to a great extent, were directly applicable to the NFRC effort. The pollution control areas of air, noise, pesticides, potable water, solid waste, radiation, wastewater, and energy were to be surveyed for major segments of the industrial portion of the economy. All this was to be but a small component of an overall national environmental/energy workforce assessment.

It was concluded that an additional study similar in design and intent to previous attempts would only compound the problems and contribute little of value upon which to base decisions essential to planning or training emphasis. Comprehensiveness was not deemed practical. Rather, some basic concerns have become apparent which should be addressed before a comprehensive study of industrial environmental workforce needs is undertaken, if reliable, useful data are to be obtained. These concerns have been expressed in the form of questions:

1) What method(s) should be used to obtain environmental workforce information from employers?

2) What conditions affecting the private sector or attitudes of management personnel interfere with obtaining information which can be translated into reliable data?

3) What size and other characteristics should a sample have to be representative of the industrial sector?

4) How consistent are definitions of environmental personnel among the various segments of industry and the public sector?

The study conducted by National Field Research Center was designed to obtain information relevant to the above questions and which may be used to formulate sound bases and methodology for future studies. Quantifiable data were not sought as end products, but were viewed as: 1) indicators of the magnitude of the anticipated increase in the industrial environmental workforce; and 2) measures of the feasibility of the survey approach used.

SURVEY APPROACH

Data purported to depict existing industrial environmental workforce levels vary greatly. Projections of future workforce needs based on any of them may be suspect. This situation must be taken into account in the determination of a general approach to develop useful projections of industrial environmental workforce needs. A survey of current employment is imperative for credible projections to be attempted. Thus, it is necessary to contact a large number of industries and select a sample to interview. The procedure used in the NFRC study is given below.

Selection of the Sample

Thirteen hundred companies were notified of the forthcoming environmental workforce study via a letter from the National Association of Manufacturers (NAM) and were invited to participate. Approximately 250 companies were contacted directly by NFRC in the course of obtaining data for the national environmental/energy workforce assessment.

Companies which accepted the invitation (either through reply to the NAM letter, or during interviews with NFRC staff) were categorized as to number of employees at the site where contact was made, location (by state and federal region), and product(s) or services. These categories were broken down in the following manner:

1) Number of employees (at single site)

* Major . . . . . 1,000 or more
* Large . . . . . 500 through 999
* Medium . . . . . 100 through 499
* Small . . . . . Fewer than 100

Because the study was not intented to be comprehensive in quantifiable results but was to be a test of approach, the small companies were eliminated from consideration for the sample. These companies often must contract for external expertise for environmental problem solving (thus the internal environmental personnel level is disproportionately low). Small businesses have a number of qualities specific to their size which affect and are affected by environmental concerns which could not be dealt with adequately in the study under the limitations noted previously. The major installations or facilities were also eliminated from consideration due to sheer magnitude and the constraints of the conditions of the study. Thus, only facilities at which one hundred to one thousand persons are employed were considered for the sample.

It should be emphasized that a more comprehensive study designed to obtain quantifiable data on which to base well-formulated workforce projections must include businesses of all sizes in the interest of accuracy.

Although gross annual sales may be an adequate alternative criterion to the number of employees for sample inclusion, this option was not exercised in the NFRC study. Capital investment was not considered as a viable alternative because of the shortcomings of that measure as noted previously.

2) Location

The significance of location for sample determination was:

a) To ensure inclusion of industries with similar products and services representative of all ten federal regions.

b) To ensure inclusion of industries with similar products and services within the same region for Regions III, VI, and V, and to provide data for comparisons within and among regions.

3) Products and Services

Because quality of information was given a higher priority at the expense of comprehensiveness, the survey was designed to include only the manufacturing and service segments of private industry. The sample was further refined to place a major focus upon one service (electrical utilities) and one type of product (chemicals). Services and manufacturers of other products were included for comparison purposes, but no attempt was made to ensure inclusion of a given minimum number of manufacturers of any one kind of product.

Description of the Sample

The size of the sample was limited by two considerations: 1) the number of companies who indicated interest in the industrial study, and 2) the decision to pursue a narrow focus consistent with the intent of the study.

Seventy-five companies were selected for inclusion in the sample based upon satisfaction of the criteria noted above. If selected companies indicated they did not wish to participate, alternatives which satisfied the same criteria were substituted. The final sample included 75 companies in these categories:

Electrical Utilities	25
Chemical Companies	10
Other Utilities	5
Other Products	35
TOTAL	75

The following table presents the companies in the sample by category and region.

TABLE I

COMPANIES INCLUDED IN SAMPLE
BY CATEGORY AND REGION

	Regions										
Category	I	II	III	IV	V	VI	VII	VIII	IX	X	TOTAL
Electrical Utility	1	2	4	6	4	2	2	1	1	2	25
Chemical Company	0	2	2	3	3	0	0	0	0	0	10
Other Utility	0	0	0	1	0	3	0	0	0	1	5
Other Product	2	2	5	9	11	2	1	1	1	1	35
TOTAL	3	6	11	19	18	7	3	2	2	4	75

The map on the following page depicts the location of the companies included in the sample by state, region, and category.

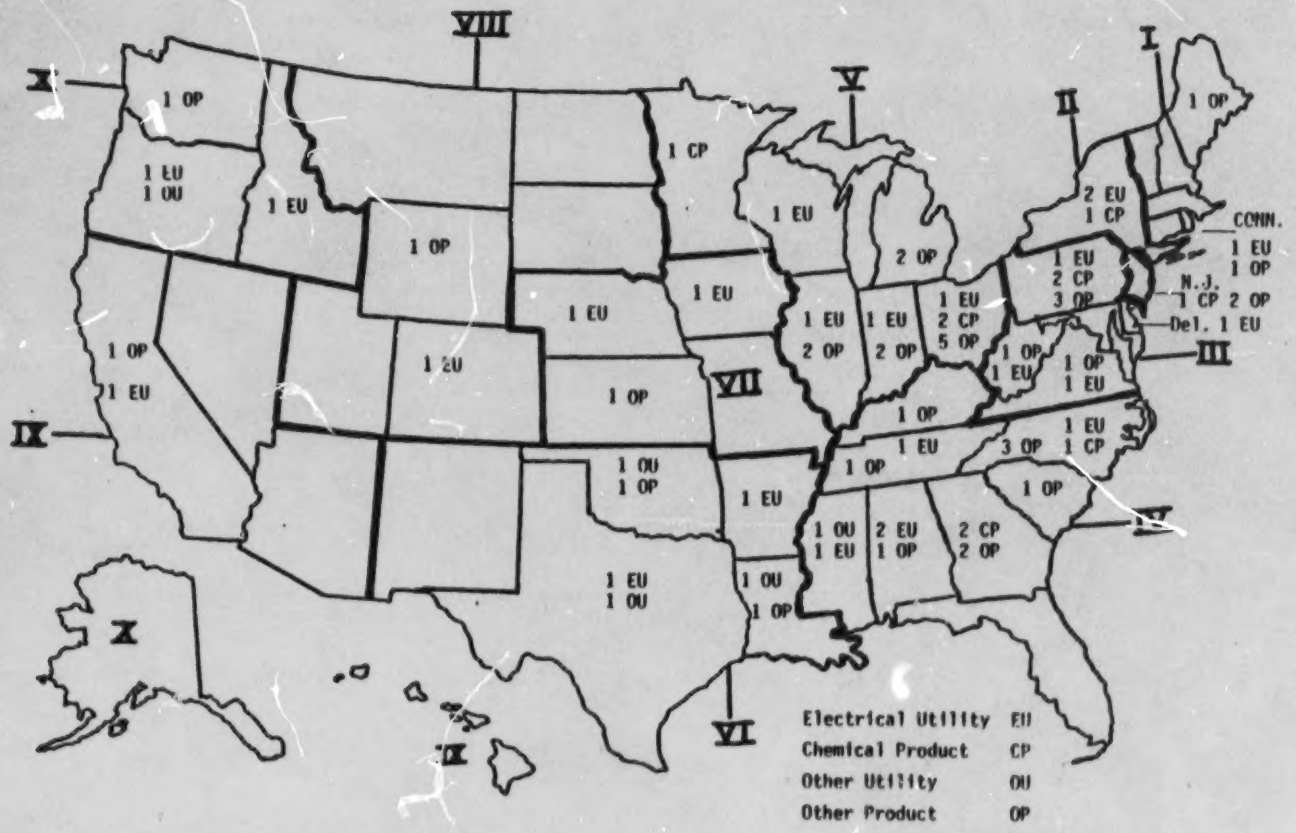
Data Collection

Two methods of data collection were used: telephone interviews and on-site interviews. Obviously, the cost per respondent differs significantly between the two methods. The object was to determine if data obtained through the less expensive means would be of sufficient quality to preclude the necessity of the expensive on-site interview. Table II below indicates the breakdown as to category of company and manner of survey technique used.

TABLE II

BREAKDOWN BY CATEGORY
AND SURVEY TECHNIQUE

	Technique		
Category	Telephone	On-Site	TOTAL
Electric Utility	15	10	25
Chemical Company	6	4	10
Other Utility	2	3	5
Other Product	20	15	35
TOTAL	43	32	75


VIII
X
I
V
II
1 OP
1 CP
2 EU
1 CP
CONN.
1 EU
1 OP
1 EU
1 OU
1 EU
1 OP
1 EU
2 OP
1 EU
2 CP
3 OP
N.J.
1 CP 2 OP
Del. 1 EU
III
1 EU
1 EU
2 OP
1 EU
2 OP
1 EU
2 CP
5 OP
1 OP
1 EU
1 OP
1 EU
1 OP
1 EU
2 OP
1 OP
IX
1 OP
1 EU
1 OU
1 OP
VII
1 EU
1 OP
1 EU
3 OP
1 CP
1 OP
1 OP
1 OU
1 EU
2 EU
1 OP
2 CP
2 OP
1 EU
1 OU
1 OU
1 OP
X
IX
VI
Electrical Utility EU
Chemical Product CP
Other Utility OU
Other Product OP

14

23

24

The questionnaire used is reproduced in the appendix. The telephone interviewers followed the questionnaire format, but were instructed to offer explanations if respondents were unsure of the questions' intent. Also, the interviewers were to take note of any comments the respondents made regarding the survey, government regulations or activity, or general remarks pertinent to industrial environmental personnel not specified in the survey instrument.

The on-site interviewers generally followed the format of the questionnaire but were instructed to deviate from it if the respondent indicated a desire to pursue any aspect in depth or to discuss matters related to industrial environmental personnel not specified in the survey instrument.

SURVEY RESULTS

Interview Completion

The following table indicates the number of questionnaires on which complete quantifiable data were obtained, presented by category of company and method of completion (survey technique).

It should be borne in mind that only companies that previously had indicated interest in the industrial study were included in the sample. Although small base numbers may skew the percentages, somewhat, the table indicates a significant variance as to complete quantifiable information which may be expected to be obtained using each of the methods.

The decision as to which method to employ must, of course, include consideration as to cost per completed interview and the total needed to fulfill the requirements of a representative sample. However, of equal importance is the nature of the information sought. The telephone interviews proved to be a poor means of obtaining non-quantifiable information because those respondents were not inclined to answer questions in depth or to discuss aspects not specifically addressed by the interviewer. The face-to-face interviews were more productive in this respect.

TABLE III

COMPLETED INTERVIEWS

BY CATEGORY AND SURVEY TECHNIQUE

	SURVEY TECHNIQUE								
	Telephone			On-Site			Total		
CATEGORY	Number Contacted	Interviews Completed	%	Number Contacted	Interviews Completed	%	Number Contacted	Interviews Completed	%
Electric Utility	15	9	60%	10	10	100%	25	19	76%
Chemical Company	6	4	67%	4	4	100%	10	8	80%
Other Utility	2	2	100%	3	3	100%	5	5	100%
Other Product	20	12	60%	15	13	87%	35	25	71%
TOTAL	43	27	63%	32	30	94%	75	57	76%

Data Obtained

The following reported results represent data obtained from the 57 completed interviews, only.

* MEETING EMPLOYMENT REQUIREMENTS

. Fifty-one respondents (89%) indicated that environmental control personnel requirements were currently being met primarily or wholly through transfer of existing personnel. The requirements which could not be achieved through transfer were met by recruitment from educational institutions or other sources. No determination could be made as to what percentage was obtained externally. Estimates by respondents varied from 10% to 25%.

. Eight of the respondents (11%) indicated that environmental control personnel requirements were primarily met through recruitment from educational institutions or other sources. No estimates for percentage were available.

* CURRENT TRAINING PROGRAMS

. Thirty-two (56%) replied that current training programs did not meet their needs. Of these, 18 stated that too much emphasis is placed upon general applied training, thus necessitating specific retraining upon employment. Fourteen said training was too theoretical and narrow, thus

necessitating retraining. It could not be determined if these replies reflected actual conditions or the respondents' personal opinions.

* NEW EMPLOYEE TRAINING

. All respondents indicated that some new employee training is available.

. Forty-three (75%) are reported as informal, on-the-job training, which may include a short, formal orientation component.

. Fourteen (25%) replied that a formal training program is required of new personnel.

* UPGRADE TRAINING

. Six (11%) reported formal upgrade training programs available to on-line personnel.

* EMERGING JOBS

. Nineteen (34%) indicated that new jobs would be emerging in their industry. Of these, 11 replied that government regulation would be a causal factor; 15 indicated changing technology as a causal factor (7 indicated both).

This response represents a change in awareness of or willingness to discuss the link between regulations and employment since the 1972 Environmental Job Opportunities Survey by Automation Industries.

Coplon and Smith reported, "In spite of the fact that many, if not most, of the respondents were quite knowledgeable of the current--and pending--state of environmental affairs (and funding, and legislation), virtually none would commit to specific manpower implications."[5]

* ENVIRONMENTAL PERSONNEL PROJECTIONS

Overall, the most glaring characteristic of the quantifiable data is the extreme degree of variance.

- Eleven (58%) of the electrical utilities indicated an anticipated increase in environmental personnel through 1981 of 5 to 15%. Eight (42%) of the electrical utilities indicated an anticipated increase of 60% or more (two estimates were considerably above 100%).

- Five of the chemical manufacturing companies indicated an anticipated increase in environmental personnel through 1981 of 5 to 10%. Three anticipated a growth of 50% or more.

- The five other utilities' estimates ranged from one expecting a steady, no-growth situation in environmental personnel required through 1981, to a high of an estimated increase of 54% by 1982.

- Of the 25 companies in the "Other Product" category, 16 provided estimates ranging from a 5 to 10% increase through 1981; four anticipated an increase of 25 to 50%; three anticipated an increase of at least 67%; and two expected an increase greater than 100% in personnel requirements through 1981.

These findings are markedly different from those of Coplon and Smith in 1972. They noted, "It is significant that only 29 (of the 110 [business establishments] sampled) anticipated future EPC environmental pollution control employment growth."[6] Only one company in the NFRC study reported no anticipated growth in environmental personnel.

There is no correlation between the total number of employees and the relative anticipated increase in environmental personnel in any of the categories. The larger anticipated increases (those exceeding 15%) represent, in 16 of the 22 instances, the estimates for companies whose current environmental control personnel level is less than 15, regardless of overall number of employees at the plant location.

* NON-QUANTIFIABLE INFORMATION

- Forty-nine of the 57 respondents explicitly cited the inability to anticipate changes in environmental regulations at the federal and state level as a source of considerable potential error in the figures they provided.

- Several respondents indicated that enforcement posture of federal and state agencies could have a significant effect on the number of environmental control personnel to be hired through 1981.

The comments below are representative of numerous remarks made by respondents in reply to the NAM letter and in the course of telephone and on-site interviews. They are included here because of the frequency and consistency with which they were made and the relevance of the conditions and/or attitudes reflected to environmental control regulatory activity and employment.

- "...major problem in dealing with the federal government in the implementation of federal guidelines and regulations has been the inconsistency of enforcement and information dissemination."

- "...too much paperwork associated with federal/state regulations. Standards do not meet local situations and they are too stringent. Compliance schedules are too short."

- "Regulatory agencies should strive for setting reasonable and practical standards, adaptable to particular geography and environment."

- "The expense of meeting federal guidelines is overwhelming. Maintaining a balance between what the government requires and what the public demands is impossible. The feds do not defend their regulations, e.g., when _____ (utility) needs their support, it's not there."

- "It is quite obvious to us now that manpower requirements in this area will rapidly increase if we are to meet legal and regulatory requirements. In our opinion, a major portion of the work requirements are unnecessary and 'nonproductive' from an ability to serve viewpoint."

- "Problems achieving acceptable environmental controls include...changing environmental standards, long lead-times in designing and installing equipment, and unproved technology."

- "...problems have been negotiating terms of permits and getting direction and guidance from regulatory agencies --local, state, federal. Now the effluent criteria are approaching a level which can't be achieved continually with available technology. Companies are told to use technologies which have not yet been proven effective."

- "EPA, cities, and industries all try to save money, so it's hard to arrive at the most practical approach to meet guidelines. It's difficult to get any action from regulatory agencies."

- "Problems include...EPA paperwork; moving targets. There is too much control on industry and little control on municipalities."

- "Our greatest deterrent has been the establishment of unrealistic limits and excessive delays due to administration of a rigid bureaucracy."

- "Problems include...the development of inappropriate regulations by federal and state personnel which cause industry uneeded (sic) expense."

- "Industry generally has a disincentive to develop new pollution control and abatement equipment because of its high and its subsequent depressing impact on markets."

Comments such as those above were often followed by statements represented by the following:

"We can't predict what they (the EPA) will do next, whether it's a new regulation, changing regulations, or deciding what to enforce, how. We can't make sound decisions about employment or anything else until we have better information about what their (the EPA) plans are."

CONCLUSIONS

Conclusions drawn from information obtained during the course of the study which pertain to the four questions listed in the OBJECTIVES section are as follows:

* WHAT METHOD(S) SHOULD BE USED TO OBTAIN INFORMATION FROM EMPLOYERS?

  . A large number of employers should be contacted initially to determine willingness to participate in a study of industrial environmental workforce personnel requirements.

  . Telephone interviews are an adequate means of obtaining a limited amount of quantifiable data if prior notification of the intention to conduct the study and the objectives sought has been given.

  . On-site interviews are preferable to telephone interviews if detailed information is desired and/or non-quantifiable data are sought. The completed response rate is markedly higher for on-site interviews than for telephone interviews.

* WHAT CONDITIONS OR ATTITUDES INTERFERE WITH OBTAINING INFORMATION WHICH CAN BE TRANSLATED INTO RELIABLE DATA?

  . The conditions and/or attitudes reflected in the quotations from respondents presented in the previous section clearly indicate an atmosphere of dissatisfaction or even hostility

toward regulatory agencies which causes or is used as an excuse for a stated inability to provide accurate figures for future environmental workforce requirements.

* WHAT SIZE AND OTHER CHARACTERISTICS SHOULD A SAMPLE HAVE TO BE REPRESENTATIVE OF THE FULL INDUSTRIAL SPECTRUM?

. The variance in the percentages of anticipated increase in industrial environmental control personnel(as reported in the previous section) is a factor of considerable importance to sample determination which ensures a comprehensive approach to environmental workforce projection efforts. The indication is that the sample must be large to be representative or that variables affecting anticipated changes in environmental workforce needs not identified in this study must be isolated and taken into account in sample selection.

* HOW CONSISTENT ARE DEFINITIONS OF ENVIRONMENTAL PERSONNEL AMONG THE VARIOUS SEGMENTS OF INDUSTRY AND THE PUBLIC SECTOR?

. The detrimental effects of the lack of generally recognized and commonly accepted definitions of environmental control personnel is most apparent as consideration is turned to the "technician" and "other" categories. The resulting confusion is particularly injurious to the accuracy of projections if, as most of the respondents indicated, the greatest potential for growth in environmental control personnel is at the technician level.

OUTCOMES

Some intangible outcomes resulting from the survey process deserve mention because of their potential impact. Many of the respondents welcomed the opportunity to provide feedback concerning regulatory procedures and their effects upon industry's ability to prepare for the future, specifically with regard to environmental workforce needs. The rather informal conditions under which this feedback was possible promoted a degree of openness not typical of more formal, established reporting procedures.

The benefits of this instance of open communication are two-fold. First, the attitudes and perceived conditions expressed in the feedback can be examined by regulatory agency personnel, evaluated and, if necessary, acted upon to establish a more satisfactory rapport between the agency and industry. Second, conditions which allow this degree of open communication can be developed to promote further instances of equal openness and value.

The topic and nature of the environmental workforce needs survey caused several respondents to take a close look at training policy and availability. As a consequence, training needs of environmental personnel are more clearly identifiable to management personnel and deficiencies of training programs are more apparent. Increased, more appropriate training for environmental personnel may be sought as a result of this greater awareness of needs.

NOTES

[1] G. H. Coplon and R. G. Smith (1972) 1972 Environmental Job Opportunities. A study prepared for the U.S. Department of Labor, Office of National Projects Administration, and the U.S. Environmental Protection Agency, Office of Planning and Management. Silver Spring, Maryland: Automation Industries, Inc., Vitro Laboratories Division.

[2] Ibid., p. 55.

[3] Ibid., p. 4.

[4] Ibid., p. 52.

[5] Ibid., p. 51.

[6] Ibid., p. 19.

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Appendix

INTERVIEW (TELEPHONE, SITE) FORMAT

Industry _____

Corporate Official _____

Title _____

Address _____

_____

Phone _____

Major Product _____

Plant Location _____

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1. Pollution Control Effort: (Check as appropriate)

Air	( )	Potable Water	( )
Noise	( )	Radiation	( )
Pesticides	( )	Solid Waste	( )
Waste Water	( )		

2. What is the current staffing level for your effort in

_____ pollution control? _____

3. What professional/technical backgrounds are represented?

(Provide numbers)

Position	1976
Engineers (by type where possible)	
Scientist (" ")	
Technician (" ")	
Other (" ")	

(Administrators are to be included by profession. Clerical is not to be included.)

4. What are the principal activities of this program? (List them in sentence format.)

5. What is the approximate rate of employee turnover for this program?

6. What annual rate of staff growth/decline do you anticipate over the next five years?

Position	1977	1978	1979	1980	1981
Engineer					
Scientist					
Technician					
Other					

7. How do you meet employment requirements?

8. Do current training programs meet your program requirements? If no, explain.

9. Do you anticipate new or unique jobs emerging in your industry over the next five years as a consequence of regulations, advancing technology, or growing public awareness?

10. Do you offer training programs for new employees? (Explain in terms of frequency, duration, subject matter.)

11. Do you offer upgrade programs for on-line personnel? (Explain in terms of frequency, duration, subject matter.)

The preceding must be asked for each of the programs which the particular industry may have. The following questions are designed to provide supplemental analytical though less quantifiable data:

12. What past and continuing problems do you have with achieving acceptable environmental controls?

13. What has been the single greatest deterrent in your efforts to achieve what has come to be called "compliance with established pollution control levels"?

14. Briefly, if your company had the option how would it have achieved adequate controls?

15. Would you like to make any suggestions for the improvement of this questionnaire in terms of the information for which it asks, or its method of presentation?

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